University of Zambia
School of Medicine

The Cestodes

3rd /4th Year MBChB

2023

Scientific Classification

- Kingdom: Animalia
- Phylum: Platyhelminths
- Class: Cestoda
- Order: Cyclophyllidea
- Family: Taeniidae
- Genus: *Taenia*
- Species: *T. solium*, *T. saginata*

Common Features of Class Cestoda

- Intestinal zoonotic parasite
- Adult worm lives in human intestine
- Larval form (Cysticercus cellulose) in pigs
- Most common in Latin America, Africa and India
- 400000 people have symptomatic neurocysticercosis in Latin America

Common Features of Class Cestoda

- Adult worm is flattened ribbon-like, without body cavity and anus
- Body composed of a head (scolex), neck and segmented strobilus (proglottid)
- Head has suckers (acetabula), rostellum that is armed with hooks
- Neck is the budding zone from which segments (proglottids) are formed

Common Features of Class Cestoda

- The strobilus consists of immature, mature and gravid proglottids
- They are hermaphroditic, there is a set of female and male reproductive organs in every mature proglottid
- Digestive tract is absent.
- Nutrition is absorbed by villi of body surface

Common Features of Class Cestoda

- They are biohelminths, intermediate hosts are indispensable
- Complex two –host life cycle
- Human beings are the only definitive host – small intestines
- Both humans and pigs can act as intermediate hosts (larvae or cysticerci)

Common Features of Class Cestoda

- Immature proglottids are transverse rectangle, located in the anterior part of the body and inner organs are developing

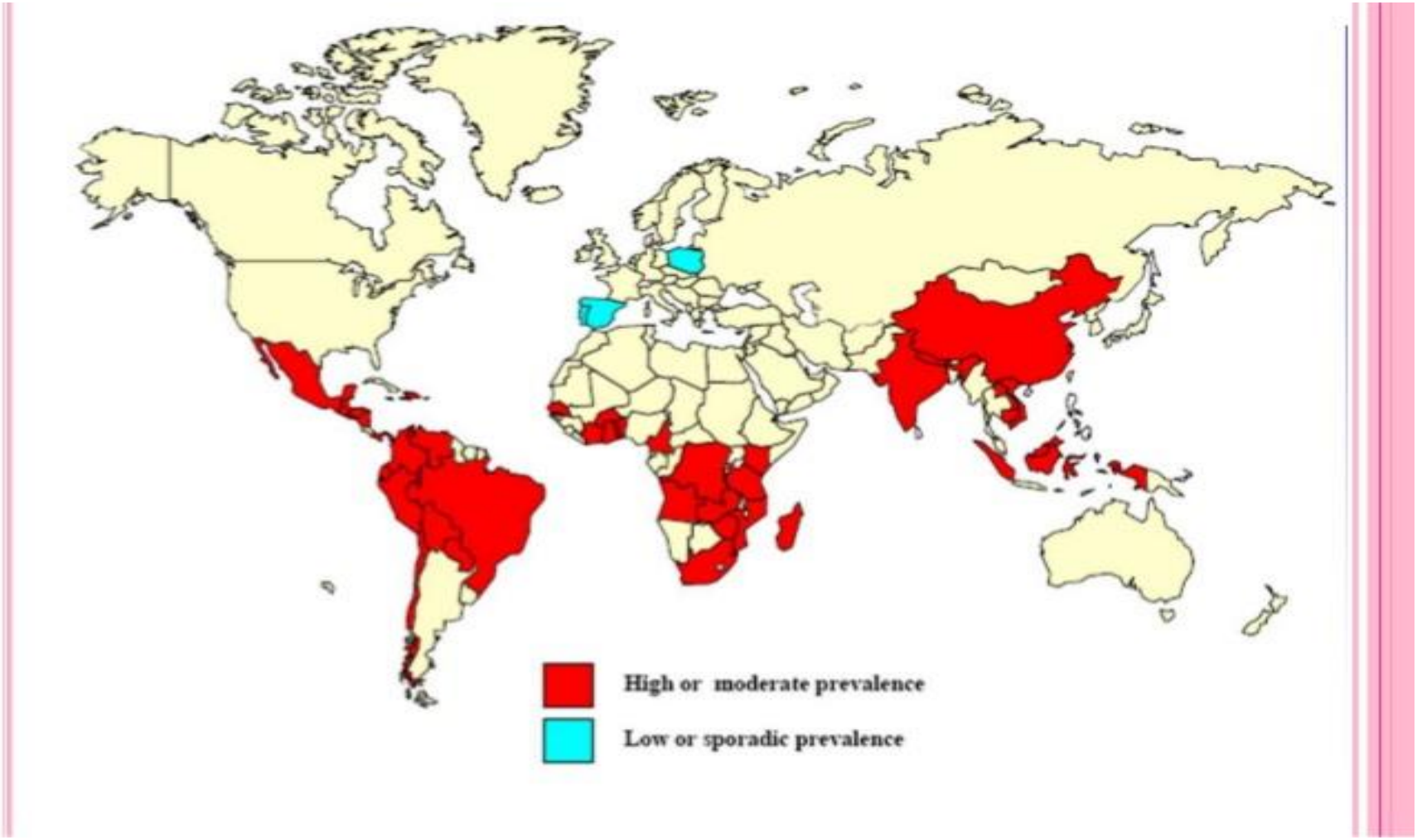
- Mature proglottids are square in shape and located in the mid part of the body, have 150-200 tests, a centrally straight uterus and 3 lobes of ovary

Common Features of Class Cestoda

- Gravid proglottids are longitudinal rectangle located in the posterior part of the body and contain a branched uterus filled with eggs

- The number of main branches on each side of the uterus stem is 7 – 13 or 15 – 20

Distribution



The Cestodes
The Tapeworms

Cyclophyllidia = suckers are cup-shaped

Pseudophyllidia = suckers are shallow, bothria

mostly aquatic intermediate hosts

CYCLOPHYLLIDEAN TAPE WORMS

Taenia solium*-*most important tapeworm of man

Also called as

= pork tapeworm

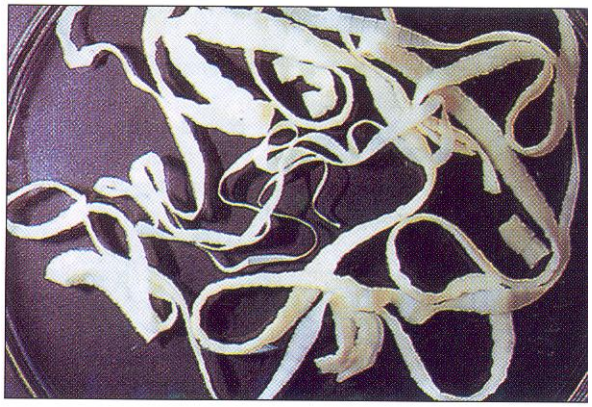
= taeniasis solium

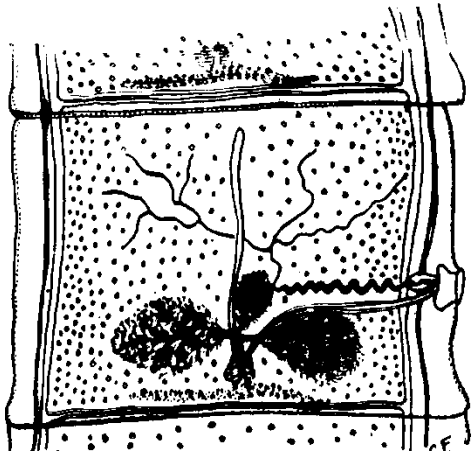
= armed tapeworm of man

Habitat: Small intestine

Morphology:

- 2–7 meters, 1000 proglottids
- attached by scolex to mucosa strobila folded in lumen
- Region of strobilization at neck
- Immature proglottids broader than they are long, mature one almost square.





Morphology

SCOLEX

- 4suckers,1 rostellum
- 25-50 hooklets arranged in a double crown
- Organ of attachment

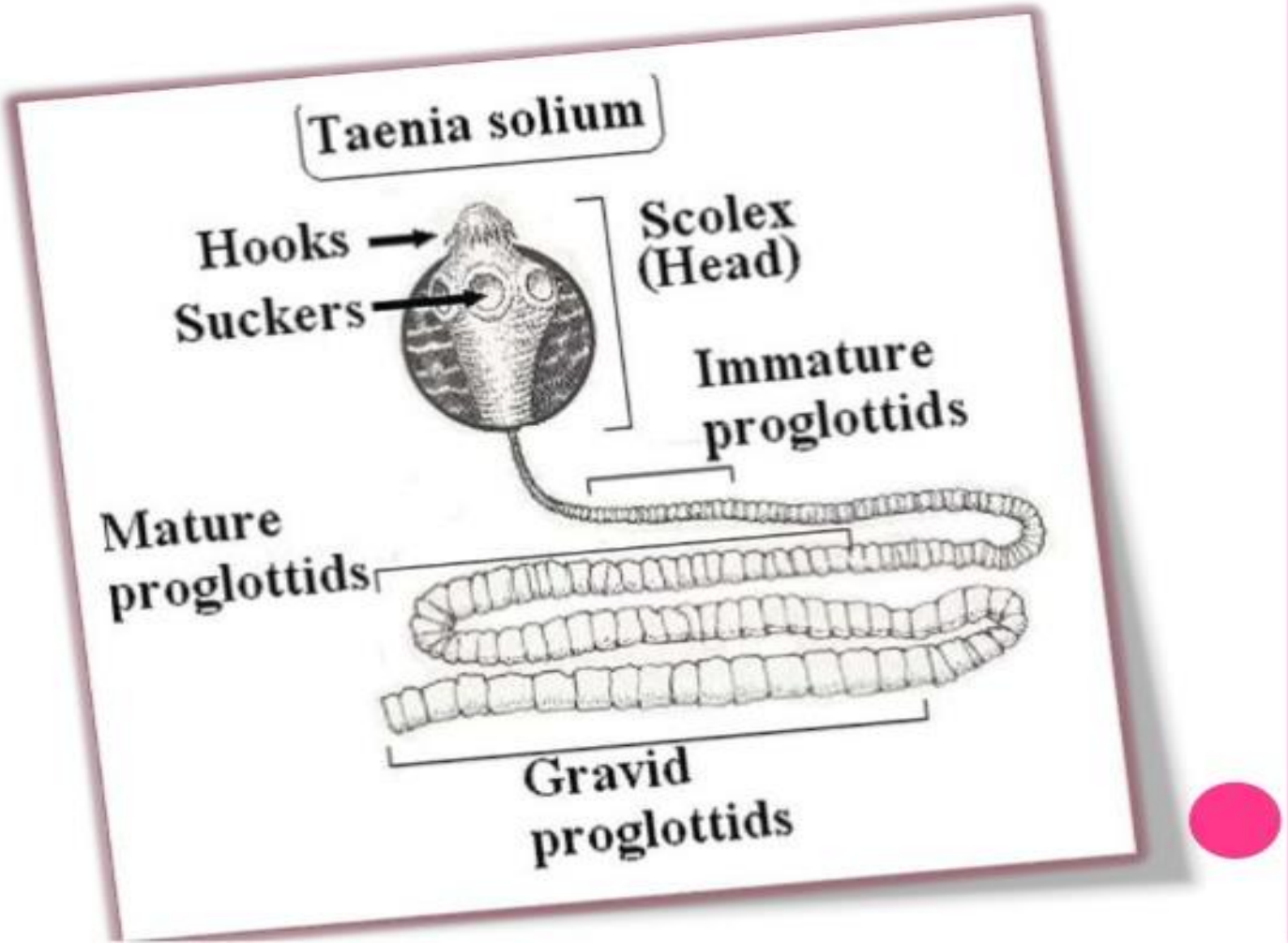
NECK

- narrowest part of the body
- Budding zone containing germinative tissue

STROBILA

- immature proglottides: width>length
- mature proglottides: width=length
- gravid proglottides: width<length
- Each proglottid is a complete reproductive unit
- Tegument-villi-nutrition

Taenia solium adult worm

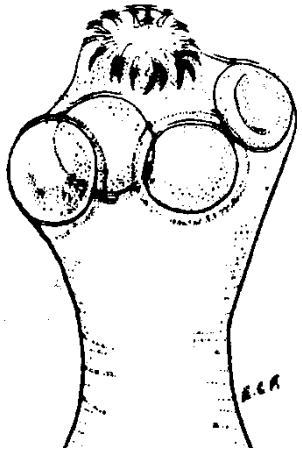


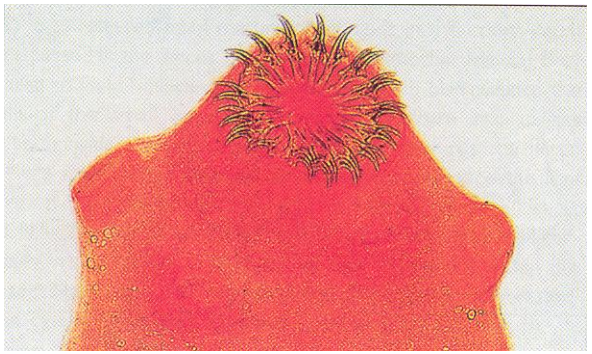
Scolex

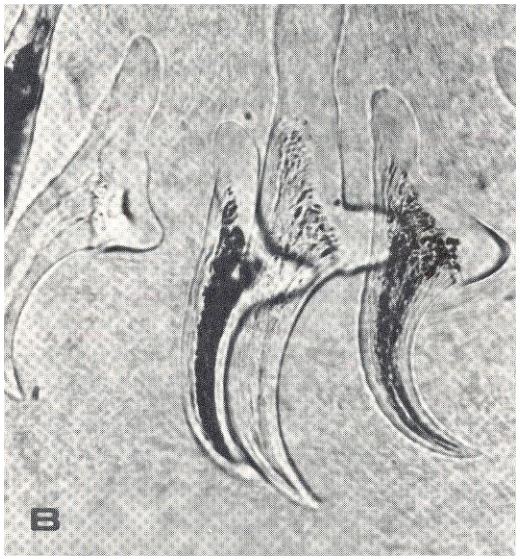
-rounded rostellum,

- 4 deep cupped suckers

- armed with double row large and small hooks



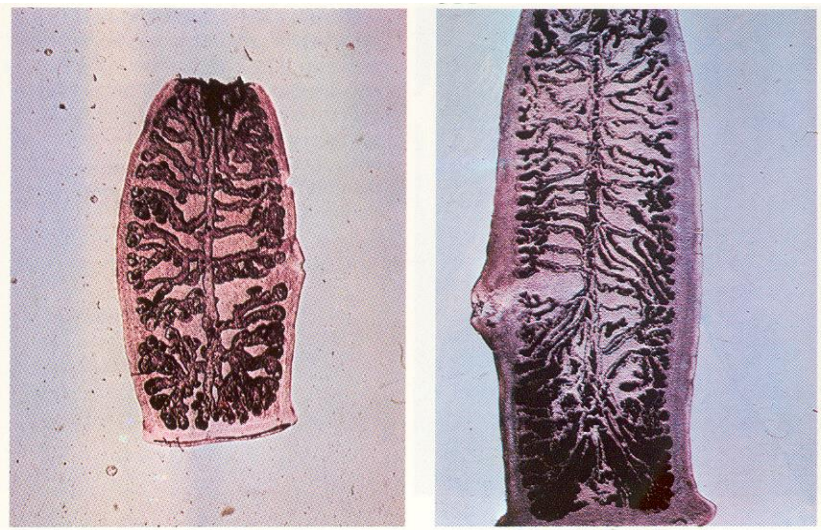




Gravid proglottids:

- **7-10 main lateral branches of the uterus**
- **separate from the strobila and passed in faeces or migrate to anus, eggs freed from proglotids**
- **Gravid proglottid contains 40000 eggs and not motile**

The gravid segments of T. solium contain a central uterus with less than a dozen lateral branches.



The gravid segments of T. saginata contain a central uterus with 15 to 20 lateral branches

Eggs of Taenia

•Thick shelled Eggs of Taenia
made up of truncated prisms cemented together

•Shed embryonated, with embryo – Onchosphere
= hooked ball with 3prs hooks

• eggs escape from uterus, can survive in soil for many weeks.

Transmission

1. Taeniasis: Man eats undercooked or raw pork. Gets infected with adult worms

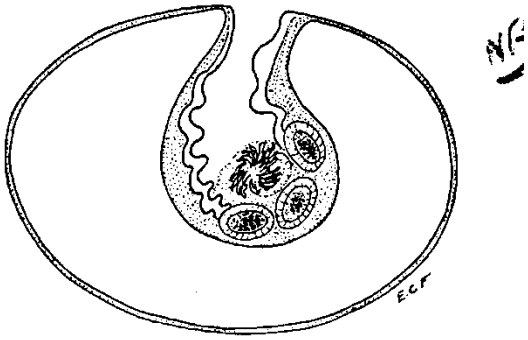
2. Cysticercosis: Human infections with larval forms

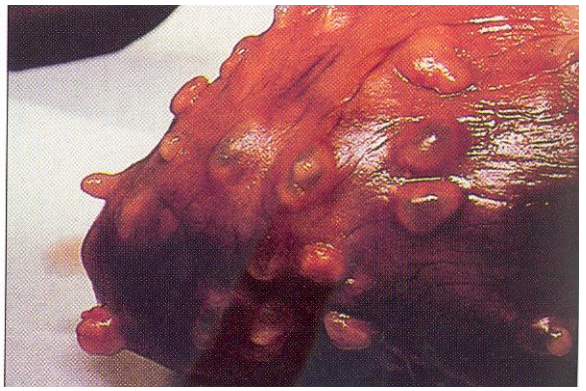
a. Ingestion of eggs in food

b. External autoinfection

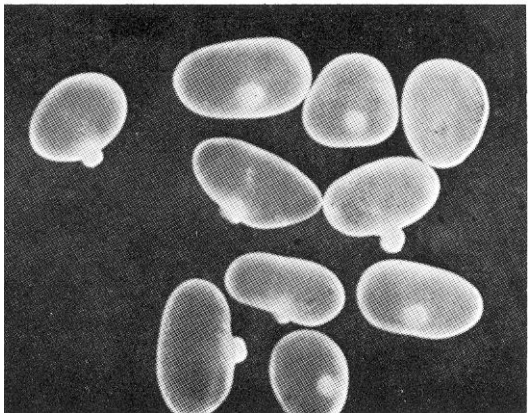
c. Internal autoinfection=occurs when a gravid proglottid is transported back to the stomach through reverse peristalsis

Taenia solium: Diagrammatic representation of a cysticercus (Cysticercus cellulosae) with scolex at distal end of scolex canal (neck) within the bladder.

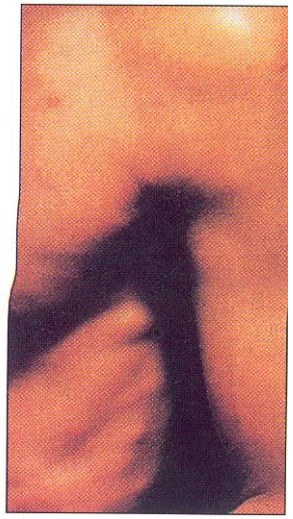




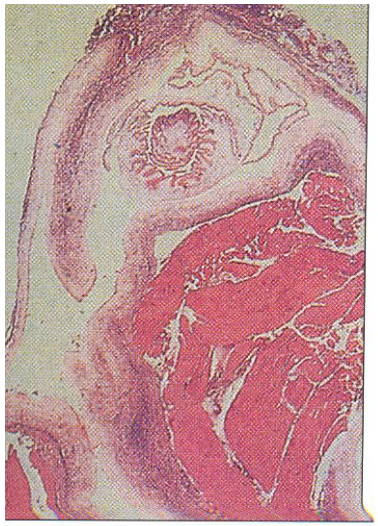
Cysticercus in pork: 'measly pork: Humans are infected with adult worms (Taeniasis) by ingesting the meat when it is inadequately cooked.



Cysticercus larvae of Taenia solium.

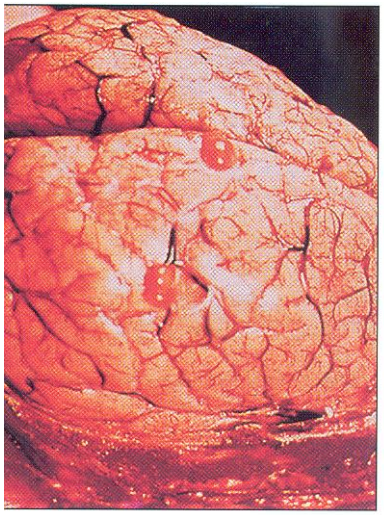


Cysticercus removed from subcutaneous Tissues This fibrous nodule containing a cyst is from the patient

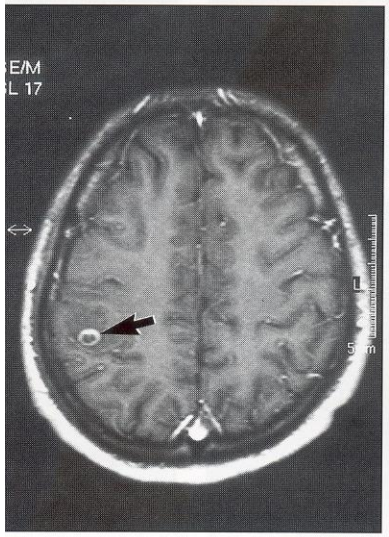


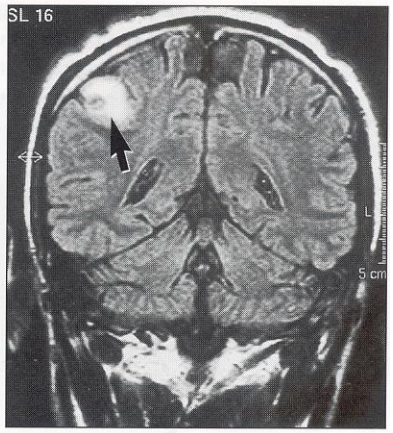
Section of cyst in human muscle The figure shows a section of a typical cysticercus cellulosa removed from a chest wall.

Fatal cerebral cysticercosis
At post mortem examination of such a case, the cysts are readily seen in various parts of the brain and brain stem.

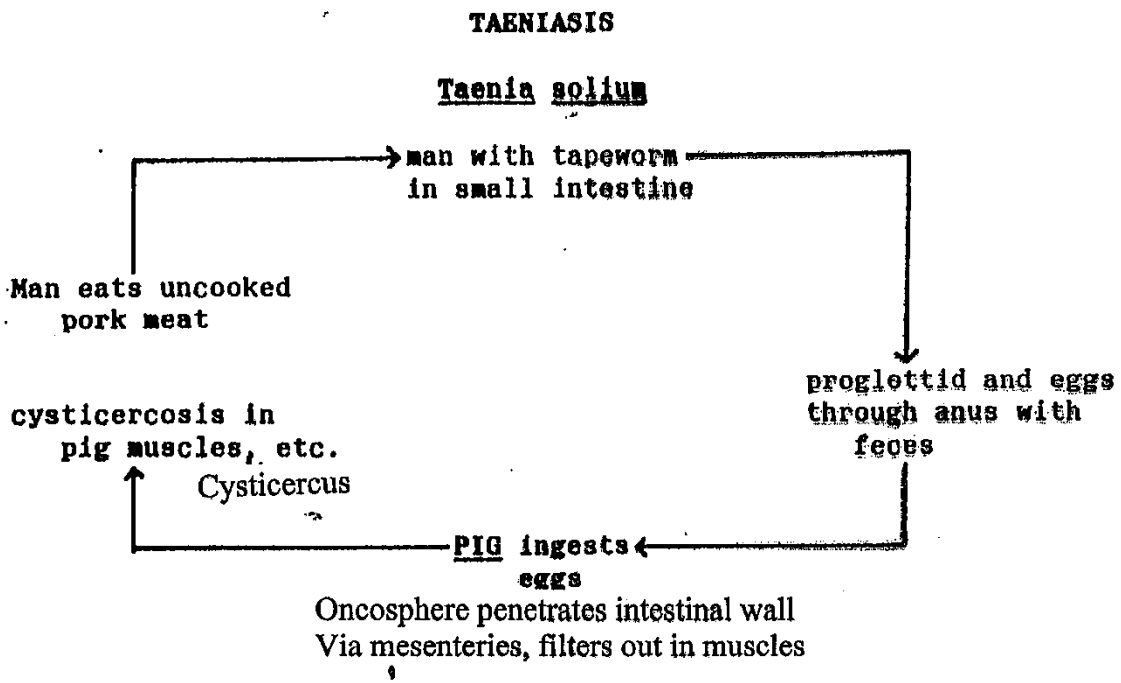


Cysticercus in pork: The larval cysticercoid stage occurs in the pig, giving rise to 'measly pork'. Man is infected by ingesting the meat inadequately cooked.


E/M
L 17

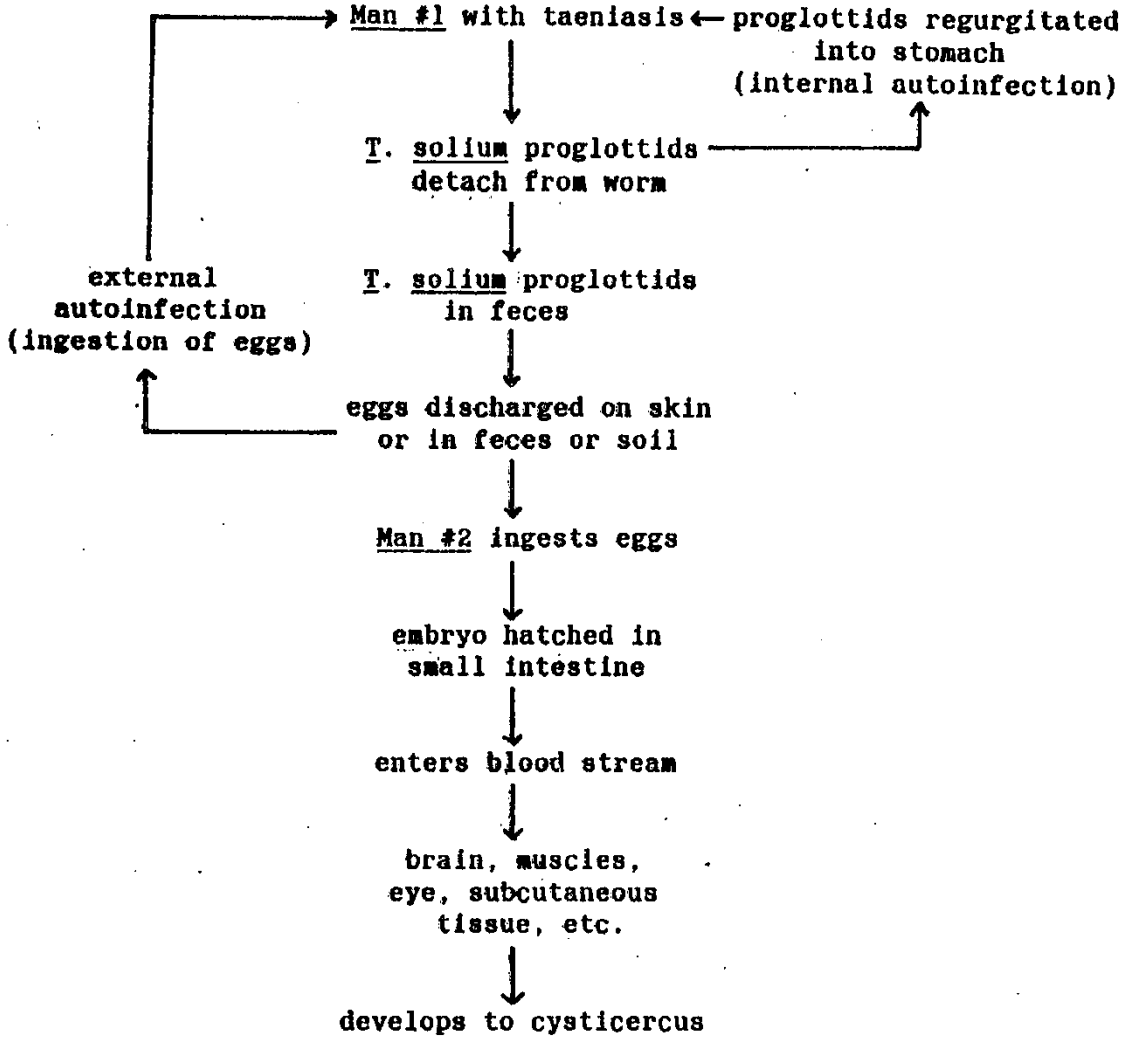

SL 16
5 cm

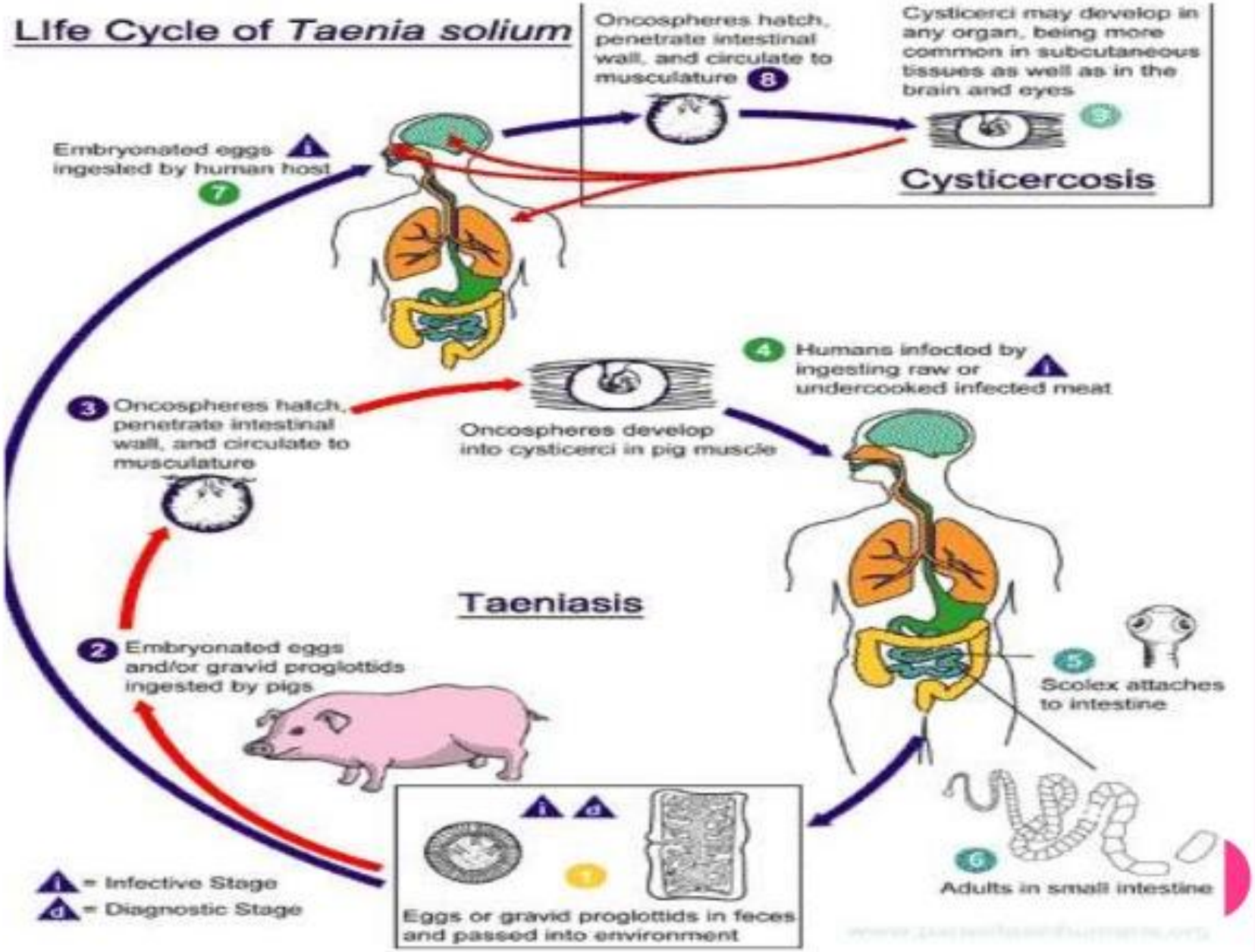
Life Cycle of T. solium

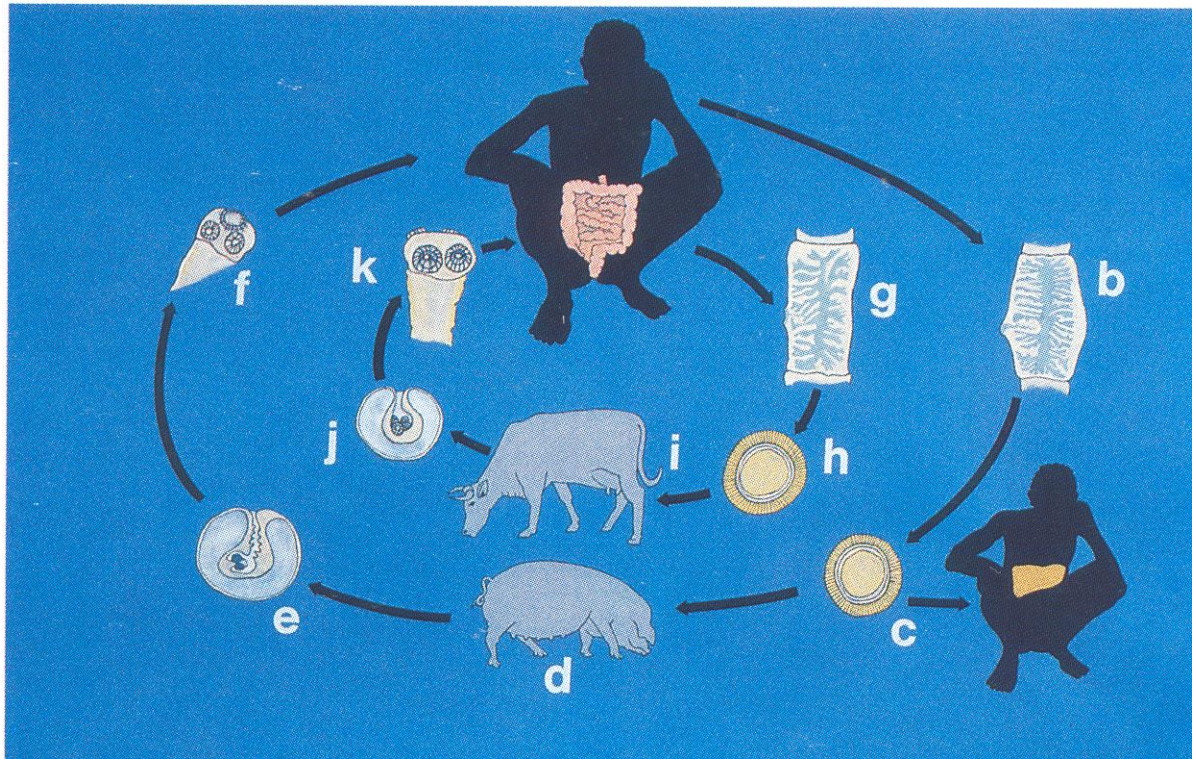


CYSTICERCOSIS

Taenia solium




Life Cycle of *Taenia solium*
Oncospheres hatch, penetrate intestinal wall, and circulate to musculature 8
Cysticerci may develop in any organ, being more common in subcutaneous tissues as well as in the brain and eyes
Cysticercosis
Embryonated eggs ingested by human host
7
4 Humans infected by ingesting raw or undercooked infected meat
3 Oncospheres hatch, penetrate intestinal wall, and circulate to musculature
Oncospheres develop into cysticerci in pig muscle
Taeniasis
2 Embryonated eggs and/or gravid proglottids ingested by pigs
5 Scolex attaches to intestine
6 Adults in small intestine
Eggs or gravid proglottids in feces and passed into environment
= Infective Stage
= Diagnostic Stage


f
k
g
b
j
i
h
e
d
c

Life cycle of *Taenia solium* and *T. saginata*

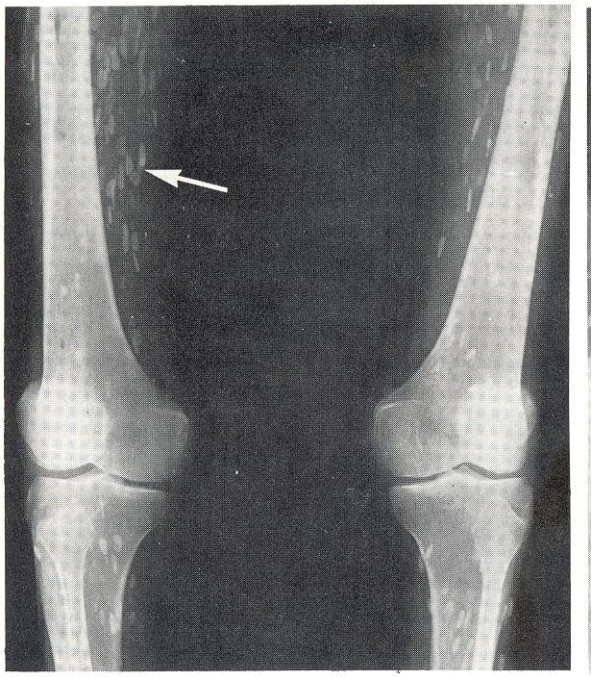
Man is the definitive host. The gravid segments (b & g) are very active and escape through the anus, releasing large numbers of eggs (c & h) in the perianal region or on the ground, where they can survive for long long periods. Faecal egg loads are, therefore, relatively light. When ingested by pigs (d) (*T. solium*) or cattle (i) (*T. saginata*), the eggs hatch, each releasing larval form , the oncosphere which migrates through the intestinal wall and blood vessels to reach striated muscle within which it encysts, forming cysticerci (e & j).

When inadequately cooked meat containing the cysts is eaten by man, the oncospheres excyst (f & k), settle in the small intestine and develop there into adult cestodes over the next three months or so. The segments of *T. solium* are somewhat less active than those of the beef tapeworm but its eggs, if released in the upper intestine, can invade the host (autoinfection), setting up the potentially dangerous larval infection known as cysticercosis in muscle or any other site.

PATHOGENESIS OF Taenia solium

1. Taeniasis: Adult worms-scolex attaches to mucosa
   a. Asymptomatic in most
   b. May cause abdominal discomfort, hunger pangs, diarrhoea, nausea, indigestion alternating with constipation
   c. Migrating proglottids from anus embarrassment or gravid proglottids in faeces (40000 eggs)

2. Larvae (Cysticercosis)



- Nodules in the eyes, muscles, brain

a. Cysticercosis cellulosae: fibrotic capsule in muscle, cellular infiltration, necrosis, calcification

- in Brain – (causes neurocysticercosis) cysts in Subarachnoids, cranium, fatal if cyst dies,

- Burns, epileptiform seizures due to heavy primary invasion of the brain
- Symptoms of Cerebral Cysticercosis
  - -disoriented behaviour
  - -transient paresis
  - -disequillibrium,
  - -meningoencephalitis
  - -failing vision
  - -CSF oesinophilia

b. Ocular Cysticercosis

-subretinal, subchoroidal

-intravitreous or in anterior chamber

-lodge in eyelid, under conjunctiva

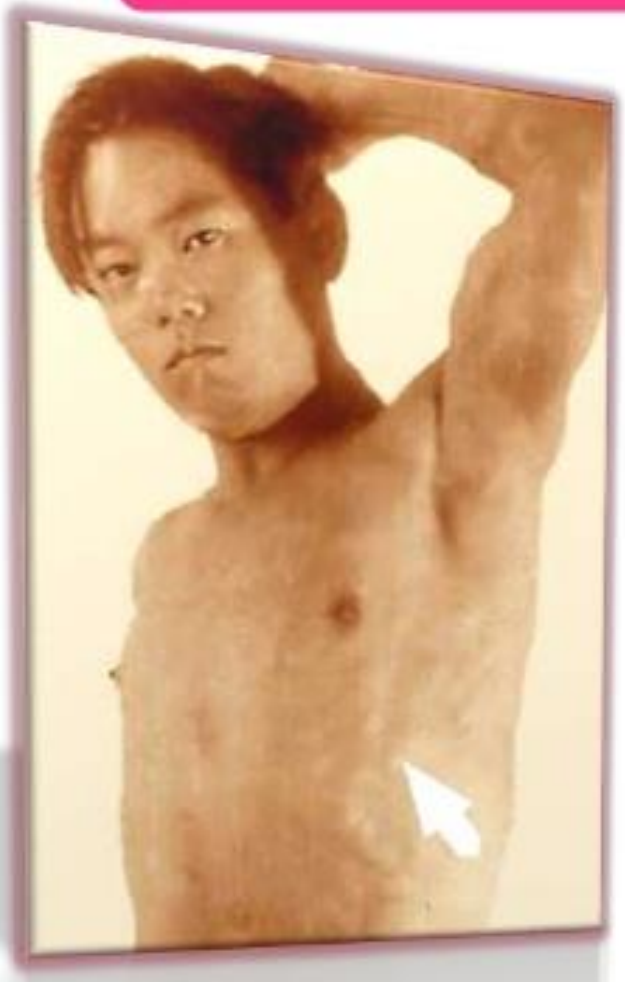
-iritis, retinitis, inflammation

c. Cysticercus racemosus:

Proliferating type, no scolex

-grape-like mass with stalks or channels at base of brain, may extend to spinal cord

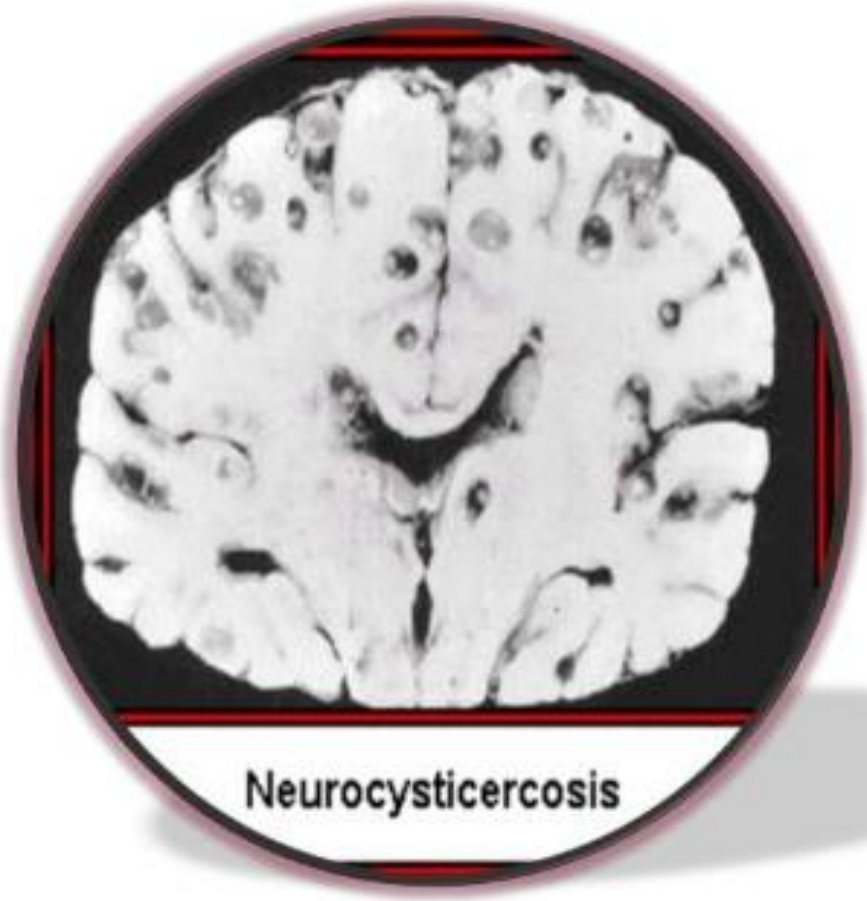
SUBCUTANEOUS



- The subcutaneous nodules are usually found in head, limbs, neck, abdomen and back. They are movable and painless.

CYSTICERCOSIS IN TONGUE

NEUROCYSTICERCOSIS



Diagnosis

1. **Taeniasis**: Direct faecal examination, Brine floatation/ Formol ether Concentration techniques, Cellophane tape techniques

(Eggs in faeces, proglottids (7-13 branches of uterus). Evacuated worm – armed rostellum)

Diagnosis

2. **Cysticercosis** – excision of larva
   cysticercosis of muscle or SubQ, suggest brain involvement

   -X-ray – calcified, CT, MRI

- CT scan of brain

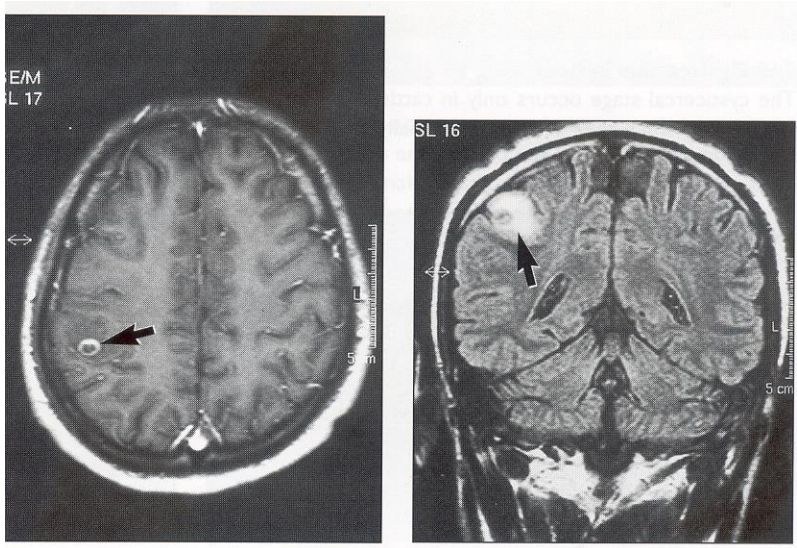
-cerebral Cysticercosis

-history of intestinal Taeniasis helpful.

3. **Ocular Cysticercosis**

- whitish grayish mass in anterior chamber

- movement of scolex is pathognomonic



Treatment of ***T. Solium***

1. Adults or Taeniasis

   Praziquantel 10mg/kg single dose or Niclosamide, or Mebendazole expulsion of worms prevents

   autoinfection and Cysticercosis

2. Treatment for Cysticercus

   a) Excision, removal of cyst, while it is

      living reduces damage to organ

   b) Praziquantel destroys cysticercus in brain + corticosteroids

3. For cutaneous infections: Metrifonate

4. Radioactive Iodine – Ab Targeted therapy

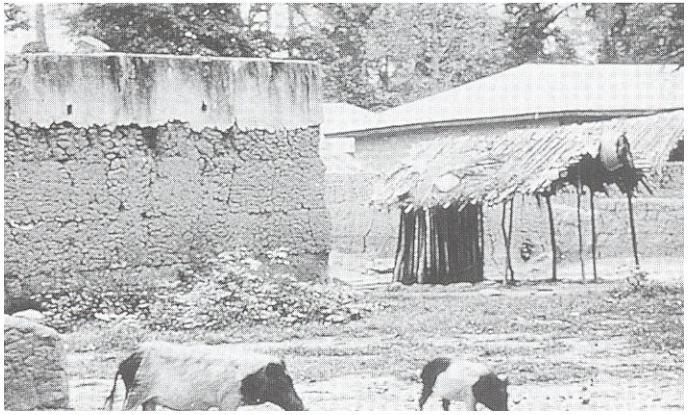
Epidemiology of *T.Solium*

Man is the usual definitive host mainly from

Eating inadequately cooked pork

1. Cosmopolitan
2. Gajdusek D.C 1978- Introduction of pigs
   in W. New Guinea, newly introduced ***T. Solium*** resulted in epidemic of burns during epileptic Seizures - heavy primary infections of cycticercosis

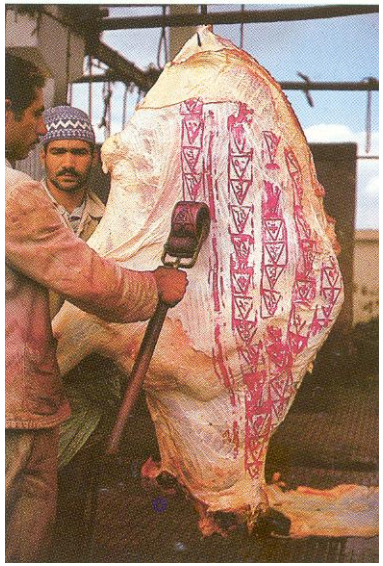
Papua New Guinea Med. J. 21:329-342



Pigs scavenging for food in in African village.

Prevention

1. Strict personal hygiene
2. Rigid Sanitary measures
3. Proper cooking of pork
   = pickled, salted not safe
4. Inspection of slaughter
   houses for “Measly pork”
5. Freezing – 20 degrees
   centigrade 12 hours
6. Gamma radiation
7. Legislature: all garbage fed to hogs/pigs must be cooked



Taenia saginata

Also called as

- Beef tapeworm infection
- Taeniasis saginata
- “unarmed tapeworm”

Habitat: Small intestine

Morphology:

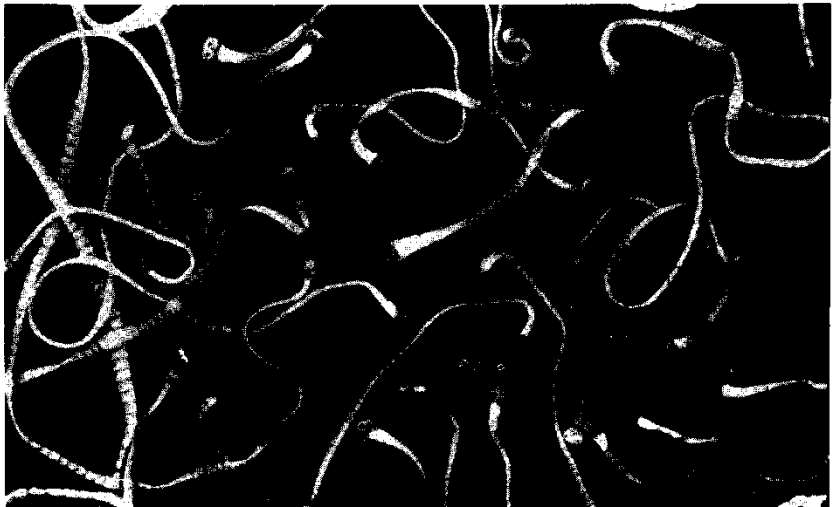
Scolex with 4 hemispherical suckers , 4 angles,

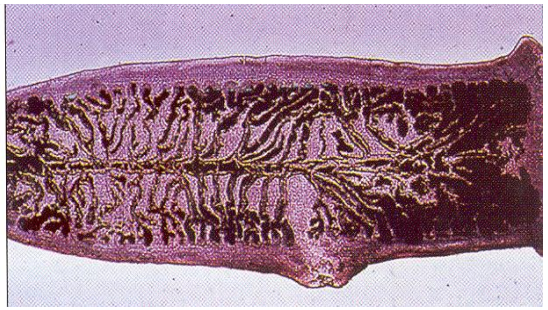
No rostellum, no hooks

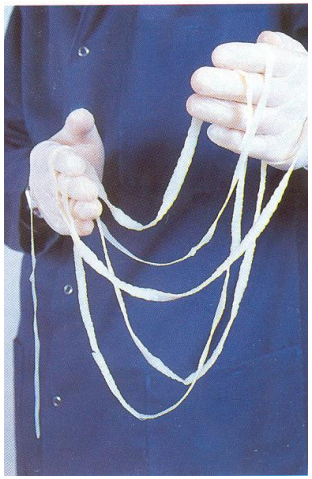
Scolex imbedded in mucosa

15m or more under favourable (25m) 1000- 2000 proglottids

- mature Proglottids broader than they are long
- Gravid proglottids narrower than longer 20 x 5mm
- Detached gravid proglottids are actively motile
- Bilateral genital pores





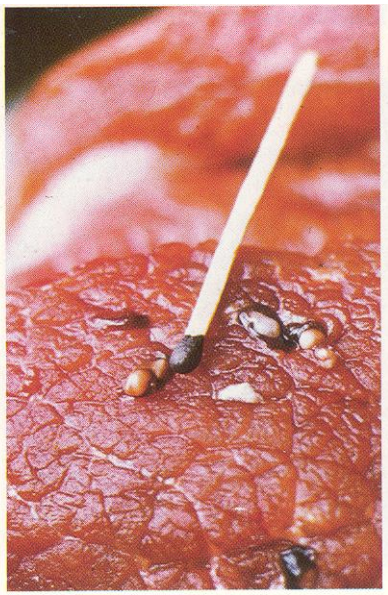


T. Saginata Morphology Cont.

- 15-20 main lateral branches of uterus
- Eggs – indistinguishable from T. Solium

LIFE CYCLE OF *T. saginata*

1. Similar to *T. solium* but intermediate hosts are herbivores: cattle, buffalo, giraffe, reindeer
2. Man is sole definitive host, infected by ingestion of undercooked meat.



Pathogenesis

Prepatent period 10-12 weeks

1. Intestinal disturbances, weight loss, intestinal obstruction, Proglottids lodge in appendix
2. Diarrhea, hunger pangs, discomfort, embarrassment at crawling proglottids
3. Causes cycticercus bovis in cattle, reindeer
4. **Eggs not infective to man hence Taenia saginata does not cause cysticercosis in man**

Diagnosis of *Taenia saginata*

1. Eggs in feces indicate taeniasis of indeterminate species, eggs identical with other *Taenia* species
2. Gravid proglottids in feces – 15-20 main lateral branches of the uterus
3. Scolex – without rostellum and hooks

Treatment of *Taenia saginata*

Niclosamide, Praziquantel 10mg/kg single dose, Bithionol,

Mebendazole

Prognosis:

1. Good with treatment
2. Infection does not cause cysticercosis, less dangerous.

Epidemiology

1. Cattle become infected from grazing on pastures polluted with human feces that contain ova. Us of sewage sludge
2. Coprophagous insects and animals disperse eggs widely

Prevention and Control of beef Tapeworm

1. Meat inspection
2. Thorough cooking of beef
3. Preventing cattle from grazing on polluted pastures, - sewage lagooning
4. Worker at feeding lots must be periodically examined for Taenia saginata infections.